

Appl. No. 09/830,894
Amdt. Dated July 30, 2004
Reply to Office action of January 30, 2004

PATENT AF
RESPONSE UNDER 37 C.F.R. §1.116
EXPEDITED PROCEDURE
ART UNIT: 1651

REMARKS/ARGUMENTS

Applicant thanks the Examiner for the careful consideration given the present application, and respectfully submits that the application is allowable in view of the following remarks.

Claims 1-4, 6-34 and 71 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is explained in the Office action that the process for “selecting” a microorganism is not clearly delineated in claim 1. Further, the Office action points out that it is unclear how “an alternative oxidant” is identified for any and all microorganisms, the nature of which is not determined.

Contrary to the rejection set forth in the Office action, applicant respectfully submits that the language of claim 1, as amended, clearly explains that any microorganism can be selected according to the present invention so long as the selected microorganism “produces the biological product and alternately uses oxygen and an alternative oxidant source other than oxygen for cellular respiration.” It is well within the ability of one of ordinary skill in the art to select such a microorganism, especially in light of the disclosure of the present invention set forth in the specification.

Regarding the rejection of claim 1 for uncertainty surrounding how to identify a proper alternative oxidant source for any and all microorganisms, the nature of which is not determined, claim 1 has been amended to more clearly express this limitation. Notably, claim 1 now recites supplying the culture medium with the alternative oxidant source “that can be used by the selected microorganism to permit cellular respiration.” Now, it is clear that the alternative oxidant source supplied to the culture medium is one that the selected microorganism can use for cellular respiration.

Finally, with regard to the rejection of claim 1 as being directed to a process using mixed cultures of microorganisms, claim 1 has been amended to recite that the process conditions are suitable for the selected microorganism. Accordingly, applicant respectfully submits that claim 1 particularly points out and distinctly claims the subject matter which applicant regards as the invention in compliance with 35 U.S.C. §112, second paragraph.

Claim 71 also complies with the requirements of 35 U.S.C. §112 for reasons analogous to those set forth above concerning claim 1.

Claims 1-6, 10 and 16 are rejected under 35 U.S.C. §102(b) as being anticipated by Varma et al.¹ However, applicant respectfully submits that Varma et al. fails to teach every feature of the present invention.

In response to the Examiner's invitation to point out the definition of "alternative oxidant" in the specification, applicant directs the Examiner's attention to page 13, lines 18-20, where it is explained that "[t]he term "oxidant", as used throughout the specification, refers to the molecules or compounds that can serve as the terminal electron acceptor in the respiratory chain of a cell." Referring the Examiner next to page 10, lines 6-12, applicant recites that "[t]he present invention is premised on the fact that various species of microorganisms can use certain alternative oxidants, such as nitrates and the like, other than molecular oxygen for purposes of metabolic or cellular respiration to avoid problems associated with oxygen limitation in bioprocesses. By using alternative oxidant sources, the serious limitations associated with oxygen supply to the cells, such as reduced cell number and foam generation can be eliminated." From these two passages alone, applicant submits that the term "alternative oxidant" is clearly defined to mean any molecule or compound, other than molecular oxygen, that can serve as the terminal electron acceptor in the respiratory chain of a cell for purposes of metabolic or cellular respiration.

The dictionary meaning of "alternative" is consistent with applicant's definition of the term "alternative oxidant." According to *Webster's Encyclopedic Unabridged Dictionary of the English Language*, page 43, Gramercy Books, © 1996, the word "alternative" means (1) "a choice limited to one of two or more possibilities, as of things, courses of action, propositions, etc., the selection of which precludes any other possibilities;" or (2) "one of the things, propositions, or courses which can be chosen." A photocopy of the cited dictionary page is attached hereto as Exhibit A. Even assuming, *in arguendo*, that the definition of "alternative oxidant" discussed in the preceding paragraph was absent from the specification, the ordinary usage of the term "alternative" along with the term "oxidant," as defined by the applicant and in the context it is used in the specification, would allow those of ordinary skill in the art to understand its definition.

Turning to the teachings of Varma et al., applicant respectfully submits that Varma et al. fails to teach every feature of the present invention, as claimed in amended claim 1. Varma et al. is directed to the growth of the microorganism *E. coli* in various culture conditions. According to Varma et al., cometabolization of glucose and acetate was observed. Pg. 3730, second col., 3rd full paragraph. However, in the Varma et al. reference glucose was provided as a carbon source for metabolization by the microorganism, not for cellular respiration. In contrast, amended claim 1 recites the step of "supplying the culture medium with a suitable amount of the alternative oxidant

¹ Varma, Amit and Palsson, Bernhard O., "Stoichiometric Flux Balance Models Quantitatively Predict Growth and Metabolic By-Product Secretion in Wild-Type *Escherichia coli* W3110", *Applied and Environmental Microbiology*, pp. 3724-3731 (Oct. 1994).

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source that can be used by the selected microorganism to permit cellular respiration . . .” Varma et al. is silent about supplying an alternative oxidant source, as well as about supplying a sufficient amount of said alternative oxidant source based at least in part on cellular respiration requirements.

Additionally, applicant maintains the earlier contention that Varma et al. also fails to teach maintaining the culture medium at a desired pH, as claimed in amended claim 1. As mentioned above, Varma et al. does suggest maintaining the temperature of the culture at 38°C, but Varma et al. is silent regarding pH, and maintenance of the pH. The Office action explains that the Varma et al. reference doesn’t teach not maintaining the pH, and for this reason, it is assumed that Varma et al. maintains a pH level. However, this line of reasoning would justify the citation of any publication that fails to mention maintaining the pH at a suitable level as teaching this feature. Accordingly, applicant respectfully submits that Varma et al. does not anticipate claim 1, as amended.

Claims 1-4, 6, 10, 13, 15, 17-20, 22, 27-29, 31-34 are rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,501,966 to Giani et al. Applicant respectfully submits, however, that Giani et al. fails to teach every feature of the present invention.

Giani et al. is directed to a process for the preparation of L-Rhamnose by fermentation of *Pseudomonas aeruginosa* (hereinafter “*P. aeruginosa*”). *P. aeruginosa* is fermented in a medium containing vegetable oils, one or more nitrogen sources, sulfate and magnesium ions and potassium and chloride ions, one or more phosphorus sources and trace elements. The pH of the nutrient solution should be between pH 5.5 and 7.5 at the start of fermentation, and does not need to be controlled during the course of the fermentation. Aeration is performed by blowing air into the stirred fermentation solution.

Giani et al. fails to teach supplying a suitable amount of the alternative oxidant source that can be used by the selected microorganism to permit cellular representation. Although Giani et al. discloses that cells are provided with a liquid culture medium containing nutrients to support growth, Giani et al. is silent on the supply of an alternative oxidant source for cellular respiration. Giani et al. also fails to teach the supply of a sufficient amount of the alternative oxidant source to satisfy cellular respiration requirements during potential oxygen shortages as claimed in amended claim 1. According to Giani et al., sterile air is blown into the stirred fermentation solution for aeration purposes. Should the demand for oxygen exceed the available oxygen within the fermentation medium, the aeration rate can be increased by adjusting one or more of the fermenter geometry, the stirrer geometry, and the energy input. Giani et al. is silent about providing a suitable amount of an alternate oxidant source such that a portion of the microorganisms will utilize the alternative oxidant source when the oxygen requirement for cellular respiration is greater than the maximum rate of oxygen supply to the culture medium. Accordingly, applicant respectfully submits that claim 1 is not anticipated by Giani et al.

Claims 1-4 and 6-34 also stand rejected under 35 U.S.C. §103(a) as being unpatentable over Giani et al. in view of Brock² and U.S. Patent No. 4,814,272 to Wagner et al. Applicant respectfully submits, however, that the combination of references fails to teach every feature of the present invention. For reasons analogous to those set forth above, the combination fails to teach the control of a suitable amount of an alternative oxidant source that can be used by the selected microorganism for cellular respiration to accommodate potential shortages of oxygen to sustain the microorganism concentration.

Further with regard to the rejection of claims 1-4 and 6-34 as being unpatentable over Giani et al. in view of Brock and Wagner et al., applicant respectfully submits that the references lack sufficient motivation therein to justify their combination. Obviousness can only be established by combining the teachings of the prior art to produce the claimed invention where there is some suggestion or motivation to do so. *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988); MPEP 2143.01. The prior art must also suggest the desirability of the claimed invention. MPEP §2143.01. Prior art references must be considered in their entirety, including disclosures that teach away from the claims. MPEP §2141.02. Further, the proposed modification cannot render the prior art unsatisfactory for its intended purpose or change the principle of operation of a reference. MPEP §2143.01.

In light of the discussion above, Giani et al. teaches away from the present invention by teaching the use of an anti-foaming agent in combination with enhanced aeration of the fermentation medium. As previously mentioned, Giani et al. teaches that sterile air is blown into the stirred fermentation solution for aeration purposes. Should the demand for oxygen exceed the available oxygen within the fermentation medium, the aeration rate can

be increased by adjusting one or more of the fermenter geometry, the stirrer geometry, and the energy input. Increasing the aeration rate can cause the fermentation solution to foam, thus requiring an antifoam agent to be introduced into the fermentation medium. In contrast, it is an object of the present invention to specifically avoid the use of antifoaming agents in that they are expensive, may affect cell metabolism, downstream product recovery and purification, and wastewater processing.

Further yet, the combination of the references would change the principle of operation of the prior art invention being modified. As the previous paragraph explained, aeration was accomplished in Giani et al. by blowing sterile air into the stirred fermentation solution. The amount of oxygen required for cellular respiration is satisfied by varying the aeration rate. Like Giani et al., Wagner et al. is directed toward an aerobic process that does not make use of an alternative oxidant source for cellular respiration. In contrast, Brock lists several oxidant sources for anaerobic respiration. Thus, the combination of Brock with Giani et al. and Wagner et al. would change the principle operation of Giani et al. and Wagner et al. from aerobic respiration to a combined aerobic/anaerobic cellular respiration. Accordingly, applicant respectfully submits that claims 1-34 are patentable over Giani et al. in view of Brock and Wagner et al.

The remaining claims are allowable for the limitations therein, and for the limitations in the claims from which they depend.

In view of the Amendments and the discussions presented above, reconsideration and withdrawal of all the rejections is respectfully requested. The claims should now be in a condition for allowance, and notice to that effect is also requested.

In the event that minor issues remain unresolved, the Examiner is hereby requested to contact the undersigned to arrange for a telephone interview to expedite disposition of this application.

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If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 500959 (089498.0338) for any additional fees required under 35 C.F.R. §1.16 or 1.17.

Respectfully submitted



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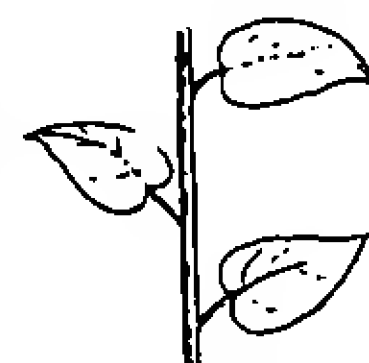
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al/pine gar'den, a rock garden.
Al/pine i/bex, an ibex, *Capra ibex*, of the Alps and Apennines, having long, heavy horns, with transverse ridges.
Al/pine pop/py, a hardy, perennial herb, *Papaver alpinum*, of the Alps, having fragrant, white or yellow flowers.
Al/pine sa/vory, a shrubby, perennial herb, *Satureia alpina*, of the Mediterranean region, having purple flowers in terminal spikes.
al/pine tun'dra, a tundra that is treeless because of high elevation rather than high latitude.
Al/pine Val/ley, a gorge in the lunar Alps, in the first quadrant of the face of the moon; about 80 miles long, and as wide as about 6 miles in places.
al/pine wall/flower, a perennial herb, *Erysium unifolium* of Spain, having grayish foliage and mauve or lilac-colored flowers.
al/pin-ism (al/pē niz/əm), *n.* (often *cap.*) mountain climbing, esp. in the Alps. [ALPINE + -ISM] —al/pin-ist, Al/pin-ist, *n.*
Alps (alps), *n.* (construed as *pl.*) 1. a mountain range in Europe, extending from France through Switzerland and Italy into Austria, Slovenia, and Croatia. Highest peak, Mont Blanc, 15,781 ft. 2. a mountain range in the northern hemisphere of the face of the moon, and forming a border of the Mare Imbrium.
al/read-y (al/red/ē), *adv.* 1. by this or that time; previously; prior to or at some specified or implied time: *When we came in, we found they had already arrived.* 2. now; so soon; so early: *Is it noon already?* [ME *alredy* ALL READY]
Usage. ALREADY is sometimes confused with ALL READY, although they are far apart in meaning. ALREADY means "previously" (*The plane had already left the airport*), while ALL READY means "completely prepared or ready" (*The troops were all ready to attack*).
al/right (al/rit/), *adv.* all right.
Usage. The form ALRIGHT is occasionally seen as a variant of ALL RIGHT, probably by analogy with READY and ALTOGETHER, but it is not considered acceptable in standard English.
Al/s., autograph letter, signed.
Al/sace (al/sās/, al/sas/), *n.* a region and former province in France between the Vosges and the Rhine. Cf. Alsace-Lorraine.
Al/sace-Lor-raine (al/sās lō rān/, -lō-, -sas/; Fr. *al zas lō ren/*), *n.* a region in NE France, including the former provinces of Alsace and Lorraine; part of Germany 1871-1917, 1940-44, 1,986,969 (1954); 5607 sq. mi. —Al/sace-Lor-rain'er, *n.*
al-Sa-hih (al/sā hē/), *n.* Islam. a compilation of hadith deemed to be authentic (A.D. c850). [*< Ar: lit., the right*]
Al-sa-tia (al/sā/shə), *n.* 1. a former cant name given to the Whitefriars district in London, England, because of the lawless characters and libertines who sought privileges of sanctuary at the monastery there. 2. an ancient name of Alsace.
Al-sa-tian (al/sā/shən), *adj.* 1. of or pertaining to Alsace or its inhabitants. 2. of or pertaining to Alsatia. —*n.* 3. a native or inhabitant of Alsace. 4. a resident or native of Alsatia. 5. Also called *Alsa'tian dog*. *Brit.* the German shepherd dog. [*< ML Alsati(a) Alsace + -AN*]
al/sike clo/ver, (al/sik, -sik, al/-), a European clover, *Trifolium hybridum*, having whitish or pink flowers, grown in the U.S. for forage. Also called *al/sike*. [after *Alstike*, near Uppsala, Sweden]
al-si-na-ceous (al/sā nā/shəs), *adj.* Bot. 1. caryophyllaceous. 2. relating to or resembling the chickweed. [*< L alsin(e) a plant (< Gk alsinē) + -ACEOUS*]
Al-sip (al/sip/), *n.* a town in NE Illinois. 3770 (1960).
Al Si-rat (al/sirāt/), Islam. 1. the correct path of religion. 2. the bridge, fine as a razor's edge, over which all who enter paradise must pass. [*< Ar, equiv. to al the + sirāt road < L (via) strāta paved (way). See STREET*]
al-so (al/sō), *adv.* 1. in addition; too; besides; as well: *He was thin, and he was also tall.* 2. likewise; in the same manner: *Since you're having another cup of coffee, I'll also have one.* —*conj.* 3. and: *He was mean, also ugly.* [ME; OE *(e)alswā* ALL (wholly or quite) so!] —*Syn.* 1. moreover.
Al-son (al/sən), *n.* a boy's given name.
Al-son-ran (al/sō ran/), *n.* 1. Sports. a. (in a race) a contestant who fails to win or to place among the first three finishers. b. an athlete or team whose performance in competition is rarely, if ever, a winning or near-winning one. 2. Informal. one who is defeated in any competition; one who attains little or no success: *For every great artist there are a thousand also-rans.*
Al-so Sprach Za-ra-thus-tra (Ger. *älzō shprākz tsā rā tōs/trä*). See *Thus Spake Zarathustra*.
Al-ston (al/stən), *n.* a boy's given name.
alt (alt), *Music.* —*adj.* 1. high. —*n.* 2. in alt, in the first octave above the treble staff. [*< Pr < L alt(um), n. use of neut. of altus high*]
alt-, var. of *alti-* before a vowel: *altazimuth*.
alt., 1. alternate. 2. altitude. 3. alto.
Alta (al/tə), *n.* a girl's given name.
Alta., Alberta.
Alta-de-na (al/tə dē/nə), *n.* a town in SW California, near Los Angeles. 40,568 (1960).
Al-tai (al/tī, -āl-, al/tī, -āl/), *n.* a territory of the RSFSR, in the S Soviet Union in Asia. 101,000 sq. mi. *Cap.* Barnaul. Also, *Altay*.
Al-tai-c (al/tā/ik), *n.* 1. a family of languages made up of the Turkic, Mongolian, Tungusic, and Korean subfamilies. —*adj.* 2. of or belonging to Altaic. 3. of or pertaining to the Altai Mountains. Also, *Al-tai-an* (al/tā/ən, -tī/-). [ALTA(I) + -IC]
Al/tai Moun'tains, 1. Also, *Altay Mountains*. a mountain range in central Asia, mostly in Outer Mon-

golia and the S Soviet Union. Highest peak, Belukha, 15,157 ft. 2. a mountain range in the fourth quadrant of the face of the moon: about 315 miles long.
Al-ta-ir (al/tā/ir), *n.* a first-magnitude star in the constellation Aquila. [*< Ar, equiv. to al the + tā'ir bird (lit., flyer)*]
Al-ta-mi-ra (al/tə mēr/ə; Sp. *äl/tā mē/rä*), *n.* a cave in N Spain, near Santander, noted for its Stone Age color drawings of animals.
al-tar (al/tər), *n.* 1. an elevated place or structure, as a mound or platform, at which religious rites are performed or on which sacrifices are offered to gods, ancestors, etc. 2. Eccles. See *communion table*. 3. (*cap.*) Astron. the constellation Ara. 4. (in a dry dock) a ledge for supporting the feet of shorings. 5. lead to the altar, Informal. to marry: *After a five-year courtship, he led her to the altar.* [ME, OE *altar* (OE also *altar*) < L *altāria* (pl.), equiv. to *alt(us)* high + *-āria*, pl. of *-āre -AR²*]
al-tar-age (al/tər/ij), *n.* 1. Eccles. a. offerings made upon an altar of a church. b. offerings made to a church. 2. an honorarium paid to a priest for services at the altar from offerings and gifts. 3. endowments for the saying of Masses for deceased persons, often at a particular altar. [ME *auterage* < AF, OF *auterage*. See ALTAR, -AGE]
al-tar board/, Coptic Church. an elaborately carved wooden panel, placed in a recess on top of an altar during the Mass, on which the chalice and paten rest.
al-tar boy/, acolyte (def. 1).
al-tar bread/, bread for use in a Eucharistic service.
al-tar card/, Rom. Cath. Ch. one of three cards having certain portions of the Mass printed on them, placed upright on the altar to assist the memory of the celebrant.
al-tar cloth/, a cloth covering for an altar. [ME]
al-tar-piece (al/tər pēs/), *n.* a painted or carved screen behind or above the altar or communion table in Christian churches; reredos. [ALTAR + PIECE]
al-tar rail/, the rail in front of an altar, separating the sanctuary from those parts of the church that are in front of it.
al-tar stand/. See *missal stand*.
al-tar stone/, mensa. Also called *al-tar slab/*. [ME *auterston*]
al-tar wine/. See *sacramental wine*.
Al-ta-vis-ta (al/tə vis/tə), *n.* a town in central Virginia. 3299 (1960).
Alt-ay (al/tī, -āl-, al/tī, -āl/), *n.* Altai.
Alt-ay Moun'tains. See *Altai Mountains*.
alt-az-i-muth (al/taz/ə mēθ), *n.* Astron. an instrument for determining both the altitude and the azimuth of a heavenly body. [ALT(ITUDE) + AZIMUTH]
altaz/imuth moun'ting, a mounting with two axes, to allow movement in both horizontal and vertical planes, used with telescopes, antennas, and precise surveying instruments.
Alt-dorf (ält/dōrf/), *n.* a town in and the capital of Uri, in central Switzerland, near Lucerne; legendary home of William Tell. 6576 (1950).
Alt-dor-fer (ält/dōr/fər; Ger. *ält/dōr/fər*), *n.* Albrecht (ält/breht), c1480-1538, German painter.
al-ter (al/tər), *v.t.* 1. to make different in some particular, as size, style, course, or the like; modify: *to alter a coat; to alter a will; to alter course*. 2. to castrate or spay. —*v.i.* 3. to change; become different or modified. [late ME < OF *alter* (< LL *alterāre* to change, worsen, deriv. of L *alter* other)] —*Syn.* 1. See *adjust, change*.
alter., alteration.
al-ter-a-ble (al/tər ə bəl), *adj.* capable of being altered. [ALTER + -ABLE] —al/ter-a-bil/i-ty, al/ter-a-ble-ness, *n.* —al/ter-a-bly, *adv.*
al-ter-ant (al/tər ənt), *adj.* 1. producing alteration. —*n.* 2. something that produces alteration. [*< L alterant- (s. of alterāns changing, prp. of alterāre), equiv. to alter other + -ant -ANT*]
al-ter-a-tion (al/tər ə/shən), *n.* 1. the act or state of altering; or the state of being altered: *The alteration improved the dress*. 2. a change; modification: *There has been an alteration in our plans.* [late ME < ML *alterātiōn- (s. of alterātiō)*. See ALTER, -ATION]
al-ter-a-tive (al/tər ə/tiv, -tər ə tiv), *adj.* 1. tending to alter. 2. Med. Obs. gradually restoring healthy bodily functions. —*n.* 3. Med. Obs. an alternative remedy. [*< ML alterātiv(us)*. See ALTER, -ATIVE]
al-ter-cate (al/tər kāt/, al/-), *v.i.* -cat-ed, -cat-ing. to argue with zeal, heat, or anger; wrangle: *They altercated in the Senate for days on end.* [*< L altercāt(us)* (ptp. of *altercāre* to quarrel), equiv. to **alterc(us)* a disputing (alter other + -cus formative suffix) + -ātus -ATE¹]
al-ter-ca-tion (al/tər kā/shən, al/-), *n.* a heated or angry dispute; noisy argument or controversy. [*< L altercātiōn- (s. of altercātiō)*. See ALTERCATE, -ION]
Syn. quarrel, contention.
al-tered chord/, Music. a chord in which at least one tone has been changed from its normal pitch in the key.
al-ter e-go (al/tər ē/gō, eg/ō, al/-), 1. a second self; a perfect substitute or deputy: *The adviser of the president acts as his alter ego during his absence.* 2. an inseparable friend. [*< L*]
al-ter i-dem (äl/tər ē/dem; Eng. *äl/tər i/dem*, al/-), Latin. another exactly the same.
al-tern (al/tərən, al/-), *adj.* Archaic. alternate; following one another. [*< L altern(us)* interchangeable, alternating, equiv. to *alter* the other (see ALTER) + -nus adj. suffix]
al-ter-nant (äl/tūr nent, al/- or, esp. *Brit.*, *äl/tūr nent*, al/-), *adj.* 1. alternating; alternate. —*n.* 2. Ling. an orthographic or phonetic variant that does not affect the meaning of a word. [*< L alternant- (s. of alternāns, prp. of alternāre)*. See ALTERN, -ANT]
al-tern-ate (v. *äl/tər nāt/*, al/-; *adj.*, *n.* *äl/tər nit*, al/-), *v.* -nat-ed, -nat-ing, *adj.*, *n.* —*v.i.* 1. to interchange repeatedly and regularly with one another in time or place; rotate (usually *fol. by with*): *Day alternates with night*. 2. to change back and forth between conditions, states, actions, etc.: *He alternates between hope and despair*. 3. *Elect.* to reverse direction or sign periodically. —*v.t.* 4. to perform in succession or one after another: *to alternate vaudeville acts*. 5. to interchange successively or regularly: *to alternate hot and cold compresses.* —*adj.*

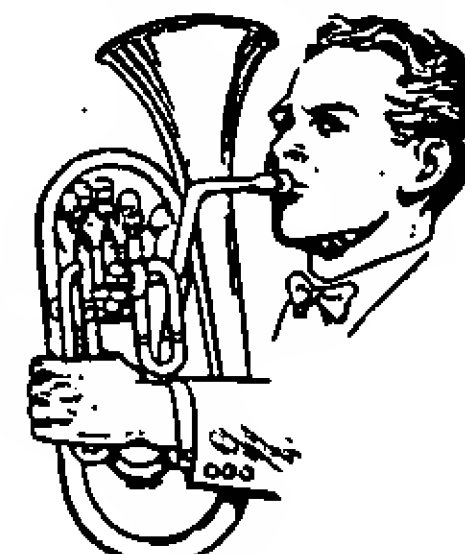
6. being in a constant state of succession or rotation; interchanged repeatedly one for another: *Winter and summer are alternate seasons*. 7. reciprocal; mutual: *alternate acts of kindness*. 8. every second one of a series: *Read only the alternate lines*. 9. alternative (def. 4). 10. Bot. a. placed singly at different heights on the axis, on each side in succession, or at definite angular distances from one another, as leaves. b. opposite to the intervals between other organs: *petals alternate with sepals*. —*n.* 11. U.S. a person authorized to fill the position, exercise the duties, etc., of another in his absence; substitute. 12. *Theat.* a. either of two actors who take turns playing the same role. b. an understudy. 13. alternative. [*< L alternā(us)* (ptp. of *alternāre*). See ALTERN, -ATE¹] —al/ter-nate-ness, *n.* —al/ter-nat/ing-ly, *adv.*



Alternate leaves

al/ternate an/gles, *Geom.* two nonadjacent angles made by the crossing of two lines by a third line, both angles being either interior or exterior, and being on opposite sides of the third line.
al-ter-na-tely (äl/tər nit lē, al/-), *adv.* 1. in alternate order; by rotation: *He alternately worked and slept*. 2. in alternate position: *Dark stripes were spaced alternately with light ones.* [ALTERNATE + -LY]
al/ternate plum/age, *Ornith.* (of birds having more than one plumage in their usually annual cycle of molts) the plumage assumed at the second molt, which is often but not always brighter than the basic plumage. Cf. *basic plumage, supplemental plumage*.
al/ternate straight/, *Poker*. See *skip straight*.
al/ternating cur'rent. See *AC* (def. 2).
al/ternating group/, *Math.* the subgroup consisting of all even permutations, of the group of all permutations of a finite set. Cf. *symmetric group*.
al/ternating light/, *Navig.* a beacon showing different colors in succession.
al/ternating personal/ity, *Psychol.* a type of multiple personality in which two or more distinct personalities appear consecutively within the same individual.
al/ternating se'ries, *Math.* a series, usually infinite, in which successive terms have opposite signs, as $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \dots$.
al/ternating volt/age, *Elect.* a voltage that reverses direction in regular cycles.
al-ter-na-tion (äl/tər nā/shən, al/-), *n.* 1. the act or state of alternating or the state of being alternated. 2. alternate succession; repeated rotation: *the alternation of the seasons*. 3. *Elect.* a single fluctuation in the absolute value of an alternating current or voltage from zero to a maximum and back to zero, being equal to one half cycle. [*< LL alternātiōn- (s. of alternātiō)*. See ALTERNATE, -ION]
alter-na-tion of genera-tions, *Biol.* the alternation in the life cycle of an organism of forms produced in a different manner, esp. the alternation of sexual with asexual generations.

al-ter-na-tive (äl/tūr nā tiv, al/-), *n.* 1. a choice limited to one of two or more possibilities, as of things, courses of action, propositions, etc., the selection of which precludes any other possibility: *You have the alternative of riding or walking*. 2. one of the things, propositions, or courses which can be chosen: *The alternative to riding is walking*. 3. a necessary or remaining course or choice: *There was no alternative but to walk*. —*adj.* 4. affording a choice of two or more things, propositions, or courses. 5. (of two things, propositions, or courses) mutually exclusive so that if one is chosen the other must be rejected: *The alternative possibilities are neutrality or war*. 6. *Logic.* (of a proposition) asserting two or more choices, at least one of which is true. Also, *alternate* (for defs. 1-4). [ALTERNATE + -IVE] —al/ter-na-tive-ly, *adv.* —al/ter-na-tive-ness, al/ter-na-tiv/i-ty, *n.* —*Syn.* 1. option, selection. See *choice*.
al-ter-na-tor (äl/tər nā/tər, al/-), *n.* *Elect.* a generator of alternating current. [ALTERNATE + -OR²]
Al-tes (al/tēz), *n.* (in the *Iliad*) a king of the Leleges and the father of Laodæus.
Alt-geld (ält/geld), *n.* John Peter, 1847-1902, governor of Illinois 1892-96.
Al-thae-a (al/thē/ə), *n.* *Class. Myth.* wife of Oeneus and mother of Toxæus, Tydeus, Meleager and Deianira.
Al-thae-me-nes (al/thē mē nēs/), *n.* *Class. Myth.* a son of Catæus who mistakenly killed his father, thus fulfilling a prophecy that Catæus would die by the hand of one of his children.
al-the-a (al/thē/ə), *n.* 1. any plant of the genus *Althaea*, comprising the hollyhocks, marsh mallows, etc. 2. the rose of Sharon, *Hibiscus syriacus*. Also, *al-thae'a*. [*< L althaea < Gk althaîā marsh mallow*]
Al-the-a (al/thē/ə), *n.* a girl's given name.
Al-thing (äl/thing, al/-), *n.* the parliament of Iceland, consisting of an upper and a lower house. [*< Icel; see ALL, THING²*]
alt-horn (alt/hōrn/), *n.* a valved brass instrument that is the alto member of the cornet family. Also called *alto horn*. [ALT + HORN]
al-though (äl/thō/), *conj.* in spite of the fact that; even though; though. Also, *al-tho'*. [ME *al thogh* ALL (adv.) even + THOUGH] —*Syn.* though, notwithstanding (that), even if, albeit (that).
alti-, a prefix occurring in loan words from Latin where it meant "high" (altitude); used in the formation of compound words: *altigram*. Also, esp. before a vowel, *alt-*. [*< L alt(us) + -i -i-*]
alt-i-graph (al/tə graf/, -gräf/), *n.* an altimeter equipped with a device for recording its measurements on a graph. [ALTI- + -GRAPH]
alt-im-e-ter (al tim/i tər, al/tə mē/tər), *n.* 1. a sensitive aneroid barometer that is graduated and calibrated, used chiefly in aircraft for finding distance above sea level, terrain, or some other reference point by a comparison of air pressures. 2. any device used for the same purpose which operates by some other means, as by radio waves. [ALTI- + -METER]
al-tim-e-ter, *thin, that; zh* as in *measure*.
CONCISE PRONUNCIATION KEY: act, able, dare, art; ebb, equal; if, ice; hot, over, order, oil, book, dose, out; up, urge; chief; sing; shoe; thin, that; zh as in *measure*.
 a = a as in *alone*, e as in *system*, i as in *easily*, o as in *gallop*, u as in *circus*; æ as in *button* (but/ən), fire (fiər), cradle (krād/əl). See the full key inside the front cover.



Althorn